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Prepared in cooperation with the U.S. Geological Survey

GEOLOGIC MAP OF THE LAS PULGAS CANYON 7.5' QUADRANGLE SAN DIEGO COUNTY, CALIFORNIA: A DIGITAL DATABASE

VERSION 1.0

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Digital Database
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2001

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DEPARTMENT OF CONSERVATION
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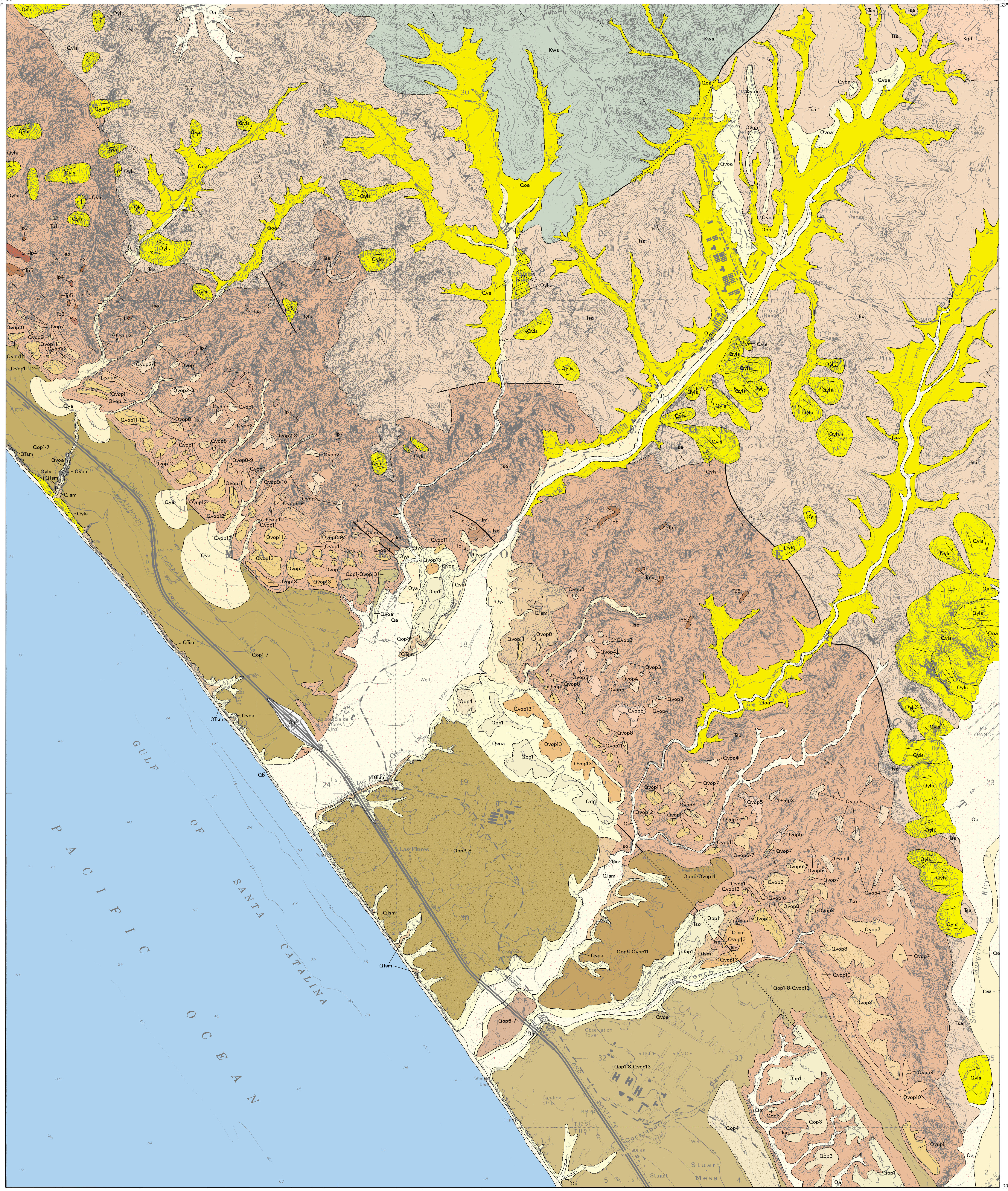

117° 30' 33° 22' 30"

117° 22' 30" 33° 22' 30"

33° 15' 117° 30'

117° 22' 30" 33° 15'

Topographic base by U.S. Geological Survey
7.5' Las Pulgas Canyon Quadrangle
Polyconic projection, contour interval 20 feet,
dotted lines 10 feet.

UTM GRID AND 1988 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:24000

MILES

KILOMETERS

THOUSAND FEET

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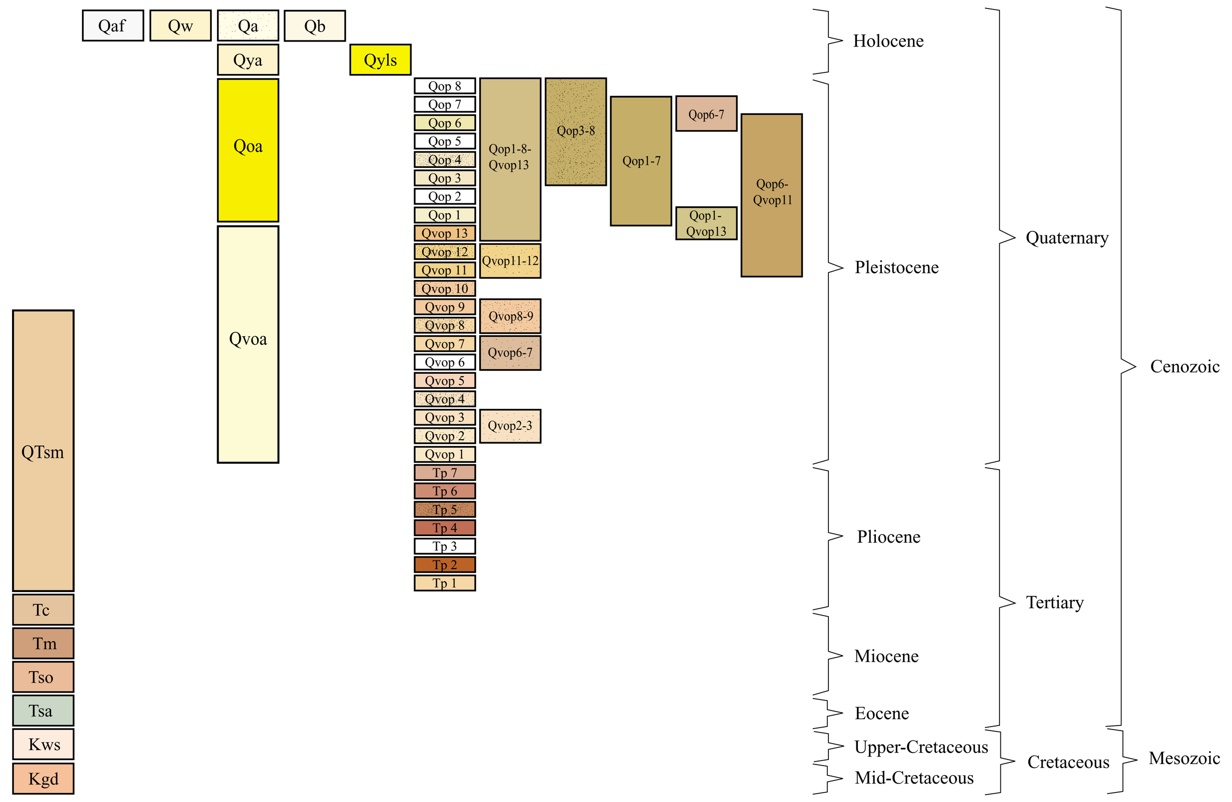
CORRELATION OF MAP UNITS



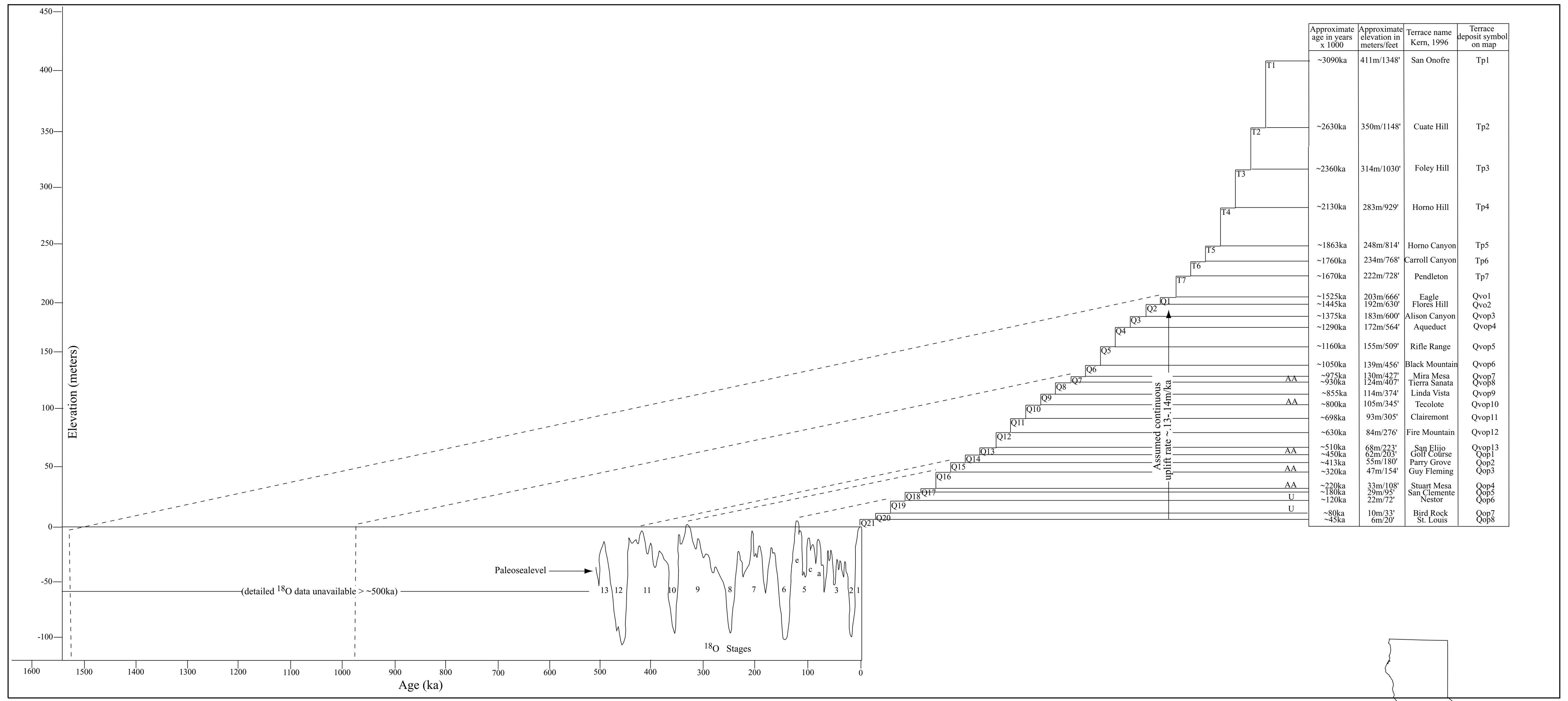


Diagram showing the approximate ages, approximate elevations, names and map symbols for emergent marine terraces and their deposits mapped in the Las Pulgas 7.5' quadrangle. An uplift rate of 1.3 m/ka is established by the elevation/age relationship using uranium series ages of corals (U) and amino acid "dates" correlations (AA) determined from materials on several of the younger (lower) terrace levels (Kern and Rockwell, 1992). The presentation of the relationship between the elevation/age and the paleosea-level curve (Chappell, 1983; Chappell and Shackelton, 1986) is modified from a study of emergent marine strandlines and associated sediments in coastal Southern California (Lajoie, and others 1991). The slopes of the diagonal correlation lines represent the rate of uplift. Slopes for the lower dated terrace materials are parallel and correlate well with specific high sea stands. If a constant uplift rate is assumed, the slopes for the upper terraces would parallel the lower ones and could be correlated with their high sea stands. The marine terrace names are from unpublished mapping by J.P. Kern, 1996. The numeric and alphabetic labels on the sea-level curve are oxygen-isotope stages (Shackelton and Opdyke, 1973).

References cited:

Chappell, J.M., 1983, A revised sea-level record for the last 300,000 years from Papua, New Guinea: Search, v.14, p. 99-101.

Chappell, J.M., and Shackelton, N.J., 1986, Oxygen isotopes and sea level: Nature, v. 324, p. 137-140.

Kern, J.P., and Rockwell, T.K., 1992, Chronology and deformation of Quaternary marine shorelines, San Diego County, California, *in* Fletcher III, C.H., and Wehmiller, J., eds. Quaternary coasts of the United States: marine and lacustrine systems: SEPM Special Publication No. 48, p. 377-382.

Kern, J.P., 1996, Unpublished geological mapping of marine terraces and marine terrace deposits in coastal southern California: Archived by the State of California Department of Conservation, Division of Mines and Geology as part of work completed for Interagency Agreement 1094-046.

Lajoie, K.R., Ponti, D.J., Powell, C.L., Mathieson, S.A., and Sarna-Wojcicki, A.M., 1991, Emergent marine and strandlines and associated sediments, coastal California; a record of Quaternary sea-level fluctuations, vertical tectonic movements, climatic changes, and coastal processes, *in* Morrison, R.B., ed. Quaternary nonglacial geology: Conterminous U.S.: The Geology of North America, v. K-2, p. 190-214.

Shackelton, N.J., and Opdyke, N.D., 1973, Oxygen isotope and paleomagnetic stratigraphy of equatorial Pacific core V28-238: Oxygen isotope temperatures and ice volumes on a 105 and 106 year scale: Quaternary Research, v. 3, p. 39-55.

DESCRIPTION OF MAP UNITS

MODERN SURFICIAL DEPOSITS - Sediment that has been recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes and in artificial fills. Soil-profile development is non-existant. Includes:

Qaf — Artificial fill (late Holocene) - Artificially compacted fill deposits.

Qw — Active channel and wash deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand and gravel deposits in active washes of streams.

Qa — Active alluvial flood plain deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand and gravel deposits in active alluvial flood plains.

YOUNG SURFICIAL DEPOSITS - Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits typically have high coarse:fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles. Includes:

Qya — Young alluvial flood plain deposits (Holocene and late Pleistocene) - Mostly unconsolidated, poorly sorted, permeable flood plain sediment.

Qyls — Landslide deposits (Holocene to Pleistocene) - Landslide slump and rock fall deposits.

OLD SURFICIAL DEPOSITS - Sedimentary units that are moderately consolidated and slightly to moderately well dissected. Older surficial deposits have upper surfaces that are capped by moderatley to well-developed pedogenic soils. Includes:

Qoa — Older alluvial flood plain deposits (Pleistocene, younger than 500,000 years) - Mostly moderately well consolidated, poorly sorted, permeable flood plain deposits.

Qop 8, Qop 7, Qop 6, Qop 5, Qop 4, Qop 3, Qop 2, Qop 1 — Older paralic deposits (Pleistocene, younger than 500,000 years) - Strandline and colluvial deposits composed of siltstone, sandstone and conglomerate. These deposits rest on the now emergent wave cut abrasion platforms preserved by regional uplift.

VERY OLD SURFICIAL UNITS - Sediments that are slightly to well consolidated to indurated, and moderately to well dissected. Upper surfaces are capped by moderate to well developed pedoenic soils. Includes:

Qvoa — Very old alluvial flood plain deposits (early Pleistocene) - Mostly well-indurated, poorly sorted, semi-permeable clay and sand flood plain deposits.

Qvop 13, Qvop 12, Qvop 11, Qvop 10, Qvop 9, Qvop 8, Qvop 7, Qvop 6, Qvop 5, Qvop 4, Qvop 3, Qvop 2, Qvop 1 — Very old paralic deposits (early Pleistocene) - Strandline and colluvial deposits conposed of siltstone, sandstone and conglomerate. These deposits rest on the now emergent wave cut abrasion platforms preserved by regional uplift.

QTsm — San Mateo Formation of Woodford (1925) (early Pleistocene and late Pliocene) - Yellowish gray, nearshore marine and paralic, siltstone, sandstone and conglomerate.

BEDROCK UNITS

Tp 7, Tp 6, Tp 5, Tp 4, Tp 3, Tp 2, Tp 1 — Paralic deposits undivided (Pliocene) - Strandline and colluvial deposits composed of siltstone, sandstone and conglomerate. These deposits rest on the now emergent wave cut abrasion platforms preserved by regional uplift.

Tc — Capistrano Formation of Woodford (1925) (early Pliocene and late Miocene) - Mostly thin bedded, dark gray, micaceous, marine, siltstone and sandstone with fossil rich limestone lenses.

Tm — Monterey Formation (late Miocene) - Light gray, marine, micaceous siltstone and sandstone. Contains very finely layered diatamaceous beds.

Tso — San Onofre Breccia (middle Miocene) - Gray, brown and reddish, medium to very coarse grained breccia composed of very angular blueshist and greenshist fragments supported in a well lithified mudstone matrix.

Tsa — Santiago Formation (Eocene) - Medium and light brown, marine and paralic, massive, arkosic sandstone containing tongues and lenses of lagoonal, greenish gray often limey mudstone and reddish brown, mostly nonmarine and cobble fanglomerate.

Kws — Williams Formation (Schulz Ranch sandstone member) - Light brown and light gray, medium grained sandstone and cobble conglomerate.

Kgd — Grannodiorite undivided (Cretaceous) - Mostly hornblende-biotite granodiorite; coarse to medium grained.

MAP SYMBOLS

Geologic contact

Fault - dashed where inferred, dotted where concealed.

Strike and dip of bedding.

Landslide: Arrows indicate direction of movement.

REFERENCES:

Boss, R.F., Olmstead, F.H., Riley, F.S., and Worts, G.F., 1958, Unpublished U.S. Geological Survey geological mapping of Camp Joseph H. Pendleton Marine Corps Base scale 1:24,000. *This excellent mapping was condensed and compiled at a scale of 1:48,000 by W.R. Moyle and released as a U.S. Geological Survey Open-File report in 1973. Moyle's maps were also appended to Ross, A., and Dowlen, R.J., (editors) 1975, Studies on the geology of Camp Pendleton, and western San Diego County, California: San Diego Association of Geologists guidebook.*

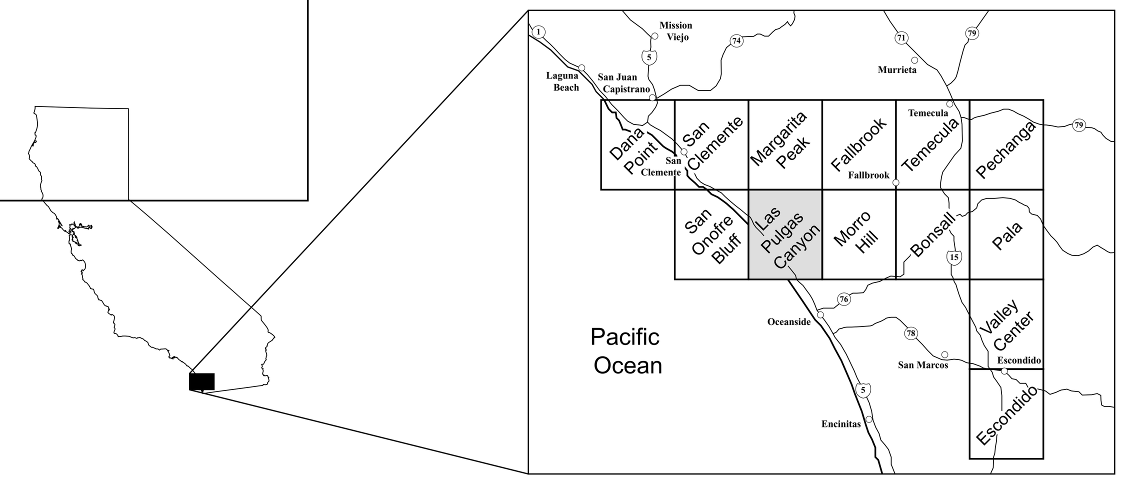
Later mapping efforts have made only very slight modifications to the bedrock mapping of Boss and others (1958), however, some have added to the better understanding of the Quaternary and Tertiary stratigraphy.
These include:

Craig, C., 1984, Geology and Eocene Sedimentology of the southwestern portion of the Camp Pendleton Marine Corps Base, San Diego County, California, 155 p., map scale 1:24,000. *This study has added to the better understanding of the Eocene rocks of the region. In addition, numerous landslides were identified in this mapping that are shown here.*

Cranham, G.T., Camilleri, P.A., and Jaffe, G.R., 1994, Geologic overview of the San Onofre Mountains, Camp Pendleton Marine Corps Base, San Diego County, California, in, Rosenberg, P.S., editor, Geology and Natural History Camp Pendleton United States Marine Corps Base San Diego County, California: San Diego Association of Geologists annual field trip guidebook, p. 11-33, map scale 1:24,000: *This paper gives a good regional depiction of the geology of the San Onofre Mountain area. Numerous landslides were identified in this mapping that are shown here.*

Ehlig, P.L., and Farley, T., 1979, Unpublished geological mapping adjacent to San Onofre Nuclear Generating Station: Mapping completed as part of the Southern California Edison Company and San Diego Gas and Electric Company investigations associated with the development of the San Onofre Nuclear Generation Station, map scale, 1:6,000. *Several of the marine terrace levels and their deposits that were mapped in great detail and numerous landslides identified in this mapping have been modified slightly here.*

Kern, J.P., 1996, Unpublished geological mapping of marine terraces and marine terrace deposits in coastal southern California: Archived by the State of California Department of Conservation, Divsion of Mines and Geology as part of work completed for Interagency Agreement 1094-046, map scale 1:24,000. *This mapping identifies marine terraces, their deposits, approximate elevations and ages in the Las Pulgas quadrangle. This mapping is modified slightly here.*



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